its Apios element, or its Wistaria element, it is equally evident that the genus long antedates both *Apios* Moench. and *Kraunhia* Raf., which the reformers keep up for these two elements respectively. Bradlea is not obscure enough to be overlooked, since it is published in Adanson's well-known work from which the reformers have derived so many of their names. It is also duly cited as a synonym of Apios by such works as Pfeiffer's *Nomenclator* and Hooker and Jackson's *Index Kewensis*. It does not appear to be antedated by any homonym, and it is truly puzzling to see why it has been rejected by those who, as they claim, admit no exception to the law of priority. However, its revival at present would be worse than useless, until the value of the fifty-year limit, suggested by the leading German botanists, can be subjected to a careful test. Mention of Bradlea is here made merely to show how little finality the advocates of the Rochester nomenclature have been able to obtain even when dealing with such a well-known genus as Apios.—B. L. ROBINSON, *Gray Herbarium*.

A CONTRIBUTION TO THE KNOWLEDGE OF THE FLORA OF TUSCOLA COUNTY, MICHIGAN.[1]

DURING the summer of 1897, while engaged in field work for the Michigan Geological Survey, in that part of Tuscola county which lies adjacent to the eastern shore of Saginaw bay, the writer found what proved from the botanical standpoint an extremely interesting tract of country. This was a narrow, irregular strip of land somewhat back from the bay shore, known locally as the "prairie," which was rarely more than two or three miles in width, frequently much less, and at no very distant time had been a part of the bottom of the bay.

As the geological history of this tract has a clearly defined bearing upon the distribution of the plants which grow upon it, and as it is plainly set forth in easily read records, I will briefly trace it.

The bay off this shore is, and apparently always has been, very shallow. There are areas of the bottom also in which there are broad sand bars. These bars are often of considerable extent, but are still beneath the surface, and are only a few feet higher than the rest of the bottom. After a time one of these bars, in a part of the bay more exposed to the action of waves, is built up until its top is raised above

[1] Read before the Michigan Academy of Science, March 31, 1898.

the surface of the water, and the island thus formed being added to by the action of winds, waves and currents, soon builds itself inward at one end nearly or quite to the mainland, forming a spit, and shutting off more or less completely a shallow bay or lagoon, which may be of small or of large extent. After the barrier is raised in front, the inclosed body of water, sooner or later, is surely filled up, and becomes solid land. If the portion of the bay bottom cut off by the "spit" was already filled with sand reefs and bars, with deeper places between them, the process of filling is hastened, for the bars are rapidly added to under the protection of the outer barrier, until their tops are near enough to the surface of the water to get sufficient light to enable seeds of water-plants, which may germinate upon them, to make successful growth. Such plants, once established, become very important factors in hastening the deposit of sediment. The growth of plants undoubtedly is also fostered by the shelter which the spit gives, as in the quiet water behind it the sand and other sedimentary deposits are practically stationary, while in front of it there is constant shifting under wave and current action, so that plants are unable to gain a foothold, where conditions are otherwise favorable.

Such a spit-formed inlet, under ordinary conditions and with no fluctuations in the level of the bay, in the course of no very great interval of time would become partly filled with a series of islands, more or less sandy, and this phase would give place in due time to a marsh, in which would be strips of sandy or gravelly soil. In the meantime the spit would extend itself in breadth and length, and would form a new boundary for the waters of the bay, upon which the wind would heap sand and débris until a dune-line was formed.

Actually one can read this story over and over again in the region under consideration, its variations being practically limitless and its editions of all sizes.

There are easily found, also, evidences of periods of subsidence of the waters of the bay, of greater or less extent and duration. The past ten or twelve years have witnessed such a period, during which the water-level fell four feet, and even now, when the water is rising again, it is easy to see that the bay will never again occupy all the ground it did before its subsidence, for in bodies of water so shallow as Saginaw bay, a change of level of even a foot makes a very marked change in the shore-line, and competition for place is so keen among plants that every available inch of ground exposed by such a change

is soon occupied by them. At least some of this is never given back to the dominion of the waters.

With these facts in mind, let us look over the "prairie" region again, and consider its aspect. The whole section is, as nearly as possible, perfectly flat, the slope to the bay being only four feet to the mile, and treeless, except for thin and straggling lines of trees which are to be seen here and there. The bay is not visible, for there is a line of low tree-covered sand dunes which shuts it off from view, and which has an exaggerated importance seen across the flat expanse of the "prairie." At times this line of dunes looks almost like a line of hills when seen from a distance, yet by actual measurement the highest parts are hardly ten feet above the water level. Besides the lines of trees mentioned there are visible small groves and scattered groups of trees and shrubs, the "islands" in the "prairie." In short, the whole character of the view suggests that about the southern end of Lake Michigan, only here all the surface features are on a much smaller scale.

An inspection of the character of the soil shows three well-defined types distributed in the following manner: (1) sandy ridges, often continuous for considerable distances, varying from a few inches to three or four feet in height above the general level, and rarely more than a few rods in width; (2) broader, more or less extensive tracts of sandy loam; (3) black, vegetable mold which constitutes the greater part of the prairie soil.

The sandy strips are the tree-covered portions, the groves and islands, and, in the light of the history just discussed, they evidently represent dune and sand-spit lines of former days of bay occupation, when the sandy loam tracts were shallows and submerged bars; and the black mold represents the deeper places which have been filled in by the growth and decay of generations of plants under such conditions that their remains were preserved in part. The floras of these three classes of soil are quite distinct and are all interesting, but that of the sandy loam is by far the most peculiar, and is worthy more exhaustive study than the writer was able to give it.

Before discussing it, however, I wish to call attention, briefly, to the plants which characterize the other two classes of soil. The black soil is so largely under cultivation that I was unable to judge much of the higher portions, but in undrained and low places the vegetation, as would be expected, was distinctly limnetic, sedges (especially *Carex*

fusca, various species of Scirpus, and Eleocharis) and marsh-loving grasses predominating. The sandy ridges were covered with oaks, which with poplars and the species of plants which usually grow with them were to be expected from the character of the soil.

My interest was chiefly centered in the plants of the sandy loam tracts on which there were found growing in greatest profusion the following species, which here are found much to the north and in most cases east of their recorded range in the state, which is quoted from Beal and Wheeler's *Michigan Flora* (1892).

Cratægus Crus-galli L. Found on the border of a tract of sandy loam near the bay. Recorded from Lansing and southward.

Lythrum alatum Pursh, reported from near Detroit and from Kalamazoo, is here very abundant in damp places all over the district.

Ludwigia polycarpa Short & Peter, from near Flint and in St. Clair county, is here common in marshy places.

Silphium terebinthaceum Jacq. Ionia, Macomb county and southward, this plant was exceedingly abundant in places covering large tracts of the poorer soil and grows as far north as Sebewaing, Huron county.

Lacinaria spicata (L.) Kuntze grew with the Silphium and rightly earned its name of blazing star by making the country side brilliant in the middle of August. This plant has been found before as far north as Ionia county and from various other parts of the state to the southward and westward.

Cacalia tuberosa Nutt., reported from the southwestern part of the state, Kalamazoo, etc., was also common here.

Steironema quadriflorum (Sims) A. S. Hitch. was conspicuous and common. This plant has a southern range and seems not to be reported from so far north in the state.

The Asclepiadaceæ were generously represented by the following species:

Asclepias purpurascens L., reported from Ionia and Clinton counties and south.

Asclepias Sullivantii Englm. Not reported in the "Michigan Flora," but found by C. K. Dodge on an island in the St. Clair river, and having a range from Ohio to Kansas and Minnesota. This plant was very abundant on the prairie soil in Akron township, Tuscola county, and probably extends northward into adjacent townships in Huron county.

Acerates floridana (Lam.) A. S. Hitchc. Recorded from but one other station in Michigan, namely South Haven on the Lake Michigan

shore, where it was found by Professor L. H. Bailey. It was very abundant in the region under discussion, growing by roadsides, in uncultivated lands and even in some cases encroaching on cultivated ground and becoming a weed.

This list might be extended, but enough species have been enumerated to show that here is a northward and eastward extension of plants, of generally southwestern range, in an entirely unexpected part of the state and separated by considerable distances from the nearest other known stations.

The soil conditions are practically those of the prairie region of the southwestern corner of the state and of the adjacent region of Indiana and Illinois. Climatic conditions are also favorable for the existence of a colony of southern plants here, as the summer isotherms are the same as those of the lower end of Lake Michigan, and even the annual isotherms are but a few degrees lower than those of the southern border of Michigan, and a slightly later spring is practically all the difference in climatic condition of this locality as compared with those to the south.

Hence, since climate and soil are both favorable we have only to account for the introduction of these species into the region to explain the presence of the colony, and to do this satisfactorily, a more careful study of the region to the southwest will have to be made. One notable fact of the occurrence of this colony at this place is that it is entirely to the north of the Saginaw lobe of the great terminal moraine of the ice-sheet. The most northerly ridges of this moraine are at least a dozen miles to the south, and they extend northward into the middle of Huron county well to the east of this region, and while the course of the morainal ridge is such that plants might follow up the shore of Lake Huron and come around the bend in the moraine into the bay region, there are no traces of such a migration in Huron county, where the flora at critical points is entirely different. If the moraine is insurmountable to plants from the south, as has been supposed, then these species must have been carried across it by winds from the southwest, as is possible in case of some of them, since their seeds have a copious pappus or long coma.

Another possible agency of transportation is that of migrating animals, which might easily carry the seeds over the higher elevations, but this seems unlikely in this case, as birds are usually moving to the southward at the season when seeds of plants are most likely to be

carried, and the migrations of other animals in the state are too irregular and insignificant to be considered as a factor in the question.

On the other hand, it is also possible that the moraine is not too high to be passed by southern plants, and that stations have been established upon it during favorable periods which were occupied long enough to permit the plants to gain a foothold on the other side, and then the intermediate stations, because of a series of successive unfavorable years, have been destroyed.

In whatever way the matter is finally decided, the fact which is worthy of record at this time is that these plants occur at this point and that they thrive there and are thoroughly at home.

It is probable that similar tracts of land in Bay and Saginaw counties will yield the same species, thus extending their range still farther northward.— CHARLES A. DAVIS, *Alma College, Alma, Mich.*